(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平8－196561

(43)公開日　平成８年(1996)８月６日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ａ６１Ｆ　9/007				
Ａ６１Ｂ　17/36	３５０			
			Ａ６１Ｆ　9/00　５０２	

審査請求　未請求　請求項の数13　ＦＤ　（全 11 頁）

(21)出願番号　特願平3－295188

(22)出願日　平成３年(1991)10月15日

(31)優先権主張番号　０７／６０４，５８５

(32)優先日　1990年10月26日

(33)優先権主張国　米国（ＵＳ）

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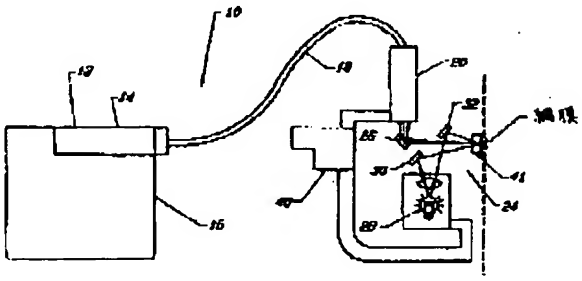
(54)【発明の名称】　網膜光凝固レーザーシステム

(57)【要約】　（修正有）

【目的】特定の治療目的に適したレーザー放射線の波長と強さ及びコンタクトレンズを選択することができると同時に、レーザーからのエネルギー吸収による角膜損傷の機会を少なくする網膜光凝固レーザーシステムを提供する。

【構成】レーザー放射線のビームを発生する装置１０と該レーザービームを網膜の表面に照射する装置２４とを有する。照射装置は網膜の表面におけるビームのスポットサイズを変えて、与えられた範囲のスポットサイズにわたって二つの交替モードで動作自在であるレンズ系を含み、該モードの一つは、網膜においてビームを集中状態に保ちながらスポットのサイズを変え、モードの他方は、焦点を変えることにより、網膜におけるスポットのサイズを変える。



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-196561
(43)Date of publication of application : 06.08.1996

(51)Int.Cl. A61F 9/007
A61B 17/36

(21)Application number : 03-295188
(22)Date of filing : 15.10.1991

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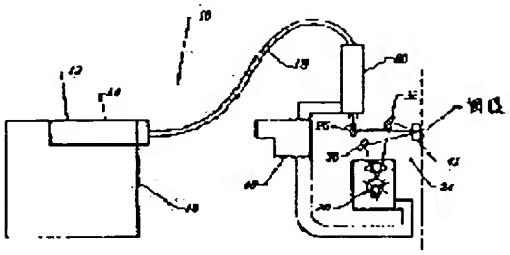
(30)Priority
Priority number : 90 604585 Priority date : 26.10.1990 Priority country : US

(54) RETINAL PHOTOCOAGULATION LASER SYSTEM

(57)Abstract:
PURPOSE: To reduce chance in damage to corneas as caused by the absorption of energy from a laser while enabling selecting of the wavelength and the intensity of laser radiation and a contact lens to match any specified treating purpose.
CONSTITUTION: This system has a device 10 for generating a beam of laser radiation and a device 24 to irradiate the surface of a retina with the laser beam. The irradiator contains a lens system which changes the spot size of the beam on the surface of the retina to let it be freely operated in two change modes over a given range of the spot size. In one mode, the size of the spot is changed keeping the beam concentrated in the retina and in the other mode, the size of the spot in the retina is changed by varying the focus.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] It is the cornea photocoagulation laser system which has the capacity to perform laser radiation of semi-concentration and not concentrating [both], for the treatment of a retina, and is :a. The wavelength suitable for the treatment of a retina, and equipment made to generate the laser radiation line beam which has strength;
b) Laser system containing equipment: which contains the adjusting device for making a beam irradiate in either concentration or the mode in which it does not concentrate, over the spot size of a certain range in the front face of a cornea in order to change the spot size of a beam and which sends a laser radiation line beam to the front face of a retina.
[Claim 2] This adjusting device is the laser system containing a lens system of a claim 1.
[Claim 3] This **** equipment is laser system of a claim 1 which contains further the optical equipment sent in response to the light from the visible light source, and the laser radiation line and this visible light source from this generator to a retina.
[Claim 4] Laser system of a claim 1 which contains further the magnifying device combined with this **** equipment in order to observe the laser radiation line beam on a retina.
[Claim 5] It is the retina photocoagulation laser system which has the capacity which irradiates the laser radiation line of semi- concentration and not concentrating [both], for the treatment of a retina, and is :a. Laser equipment which has the wavelength suitable for the treatment of a retina, and the capacity to generate the laser radiation line beam which has strength;
b) Laser centralized equipment combined with this laser equipment in a beam over the spot size of a certain range in the point that a beam meets with a retina concentration or in order to make it un-concentrate in order to adjust the spot size of a beam;
c) Visible light source;
d) Optical equipment combined with this laser centralized equipment and this visible light source in order to send in response to the laser radiation line from this laser centralized equipment, and the light from this visible light source to a retina;
e) Retina photocoagulation laser system containing magnifying device: for observing the laser radiation line beam on a retina.
[Claim 6] This laser centralized equipment is the laser system containing a lens system of a claim 1.
[Claim 7] a) Equipment which generates a disposal beam;
b) Are equipment which sends this beam on the surface of a retina, and this equipment contains the adjusting device for changing the spot size of the beam in the front face of a retina. This adjusting device can operate freely in two shift modes over the spot size of the given range. one of the modes of these It is the retina photocoagulator which changes the size of a spot, maintaining a beam at a concentration state in a retina, and contains equipment: which changes the size of the spot in a retina when another side in this mode changes a focus.
[Claim 8] This adjusting device is retina photocoagulator containing a lens system of a claim 6.
[Claim 9] Retina photocoagulator of a claim 6 in which this **** equipment contains further the optical equipment sent in response to the light from the visible light source, and the laser radiation line and this visible light source from this generator to a retina.
[Claim 10] Retina photocoagulator of a claim 6 which contains further the magnifying device combined with this **** equipment in order to observe the laser radiation line beam on a retina.
[Claim 11] It is the retina photocoagulator which has the capacity which irradiates the laser radiation line of semi-concentration and not concentrating [both], for the treatment of a retina, and is :a. The wavelength suitable for the treatment of a retina, and equipment which generates the laser radiation line beam which has strength;
b) It is the adjusting device into which the size of the spot in a retina is changed by this equipment's being able to operate freely in two shift modes over the spot size of the given range in the adjusting device for changing the spot size of the beam in the front face of a retina, and one of the modes of these changing the size of a spot, maintaining a beam at a concentration state in a retina when another side in this mode changes a focus.;
c) Optical equipment combined with this adjusting device since the light is generated, and in order to send to a retina in response to the beam of a laser radiation line with the light;
d) Laser system containing magnifying device: for observing the beam of a laser radiation line in a retina.
[Claim 12] This adjusting device is the laser system containing a lens system of a claim 11.
[Claim 13] It is the retina photocoagulation laser system which has the capacity which irradiates the laser radiation

line of semi- concentration and not concentrating [both], for the treatment of a retina, and is :a. Laser which has the wavelength suitable for the treatment of a retina, and the capacity to generate the laser radiation line beam which has strength;
b) Lens system by which a beam is combined with this laser in a beam over the spot size of a certain range in the part which meets with a retina concentration or in order to make it un-concentrate in order to adjust the spot size of a beam;
c) Visible light source;
d) Laser system which contains slit lamp: combined with this laser centralized equipment and this visible light source in order to expand a retina so that the position, the spot size, and the focus of the laser radiation line on a retina may be seen, in order to send in response to the laser radiation line from this laser centralized equipment, and the light from this visible light source to a retina.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001] Generally this invention relates to retina photocoagulation laser system especially about medical-application laser system.
[0002] Laser is widely used for various medical-application ways today. In order to destroy a tumor of the skin and to remove the pigmentation of the skin which is not desirable, laser is used for the skin medicine target. The doctor used laser for destroying the calculus in a body cavity like a renal calculus. Laser is widely used in the blood coagulation produced especially simultaneously with incision formation, the wavelength which brings about the thermocautery of a small vessel, and strength, in order to cut and **** the organization of 1. Calling the "bloodless" operation, photocoagulation technology found out the illness of an eye, and the especially big use for the sick treatment related to the retina. Laser is especially useful in this use because of the need of preventing blood going into the glass Mr. liquid of an eyeball for the difficulty of the contiguity accompanying the operation in an eyeball.
[0003] In spite of having made big progress in the eyeball operation using laser, many problems still remain. One of the problems of these is the injury to the cornea produced from passing a cornea, as laser reaches a retina. Although the liquid between a cornea and a cornea, and a lens looks transparent, it absorbs the energy of laser. In the case of an old age person, cataract is common and absorption of energy is larger than a normal cornea. Similarly, the bottom liquid of a cornea may induce immunoreaction and this brings about the cloudiness and the increase in an optical absorption of a result in liquid.
[0004] When performing what kind of cornea transparency laser surgery, you have to restrict the energy strength of the laser beam at the time of horizontal **** for a cornea. The high energy absorption by the cornea may produce an injury. This problem is composite-ized according to the fact that a doctor has to use a special contact lens for a patient so that arrangement of the laser beam to a patient's retina can be visualized. Since many of these lenses have the effect which reduces the diameter of the laser-beam portion near the cornea compared with the case where it is not used, it makes the energy density to a cornea actually increase.
[0005] Therefore, while the doctor maintained the suitable energy density required for treatment to the retina, he tried to make possibility of the injury to a cornea into the minimum. The doctor will choose the smaller spot size with a low energy setup more, since concentration or the semi- concentration beam is desirable in many cases.
[0006] One alternate method which reduces a cornea energy density is using the beam which is not concentrated, i.e., the beam which intersects a retina in the point which is separated from the focal plane (namely, narrowest portion) of a laser beam. When a beam is irradiated with a concentration beam, irradiation of the non-concentrating beam of the laser radiation line to a retina can produce a low energy density in a cornea far rather than possible.
[0007] Prevention of the injury to a cornea was set aside, and in a certain treatment, a certain doctor has found out that the non-concentrating beam is more more suitable, when the disposal zone formed especially keenly is not desirable. In such a case, a doctor chooses to use a non-concentrating beam.
[0008] Speaking generally, designing the well-known system so that a beam may be irradiated only in concentration or the mode in which it does not concentrate. Coherent (Coherent) model which can irradiate the concentration beam of the spot size of one range, and the non-concentrating beam of the spot size of other ranges Laser system like No.920 exists. In the case of the latter, spot size is changed by moving the focal plane of a laser beam out of the flat surface of a retina. However, the equipment which gives a doctor the freedom of choosing concentration or a non-concentrating spot in the spot size of the overlapping field does not exist.
[0009] In spite of the difficulty relevant to a cornea injury, and the need of using both concentration and a non-concentrating beam, in the laser-beam spot size of a certain given group, the conventional laser system is designed so that a laser beam may be irradiated only in the one mode concentration or in which it does not concentrate. Therefore, in the beam spot size of a certain range, there is need of the independent laser system for eye treatment which can irradiate a laser beam in concentration or the mode in which it does not concentrate at a shift.
[0010] The difficulty accompanying the above-mentioned conventional-type laser system is conquered by this invention which gives retina photocoagulation laser system. Wavelength to which this system fitted :retina treatment, and laser equipment which can generate the laser radiation beam which has strength; In order to adjust the spot size of a beam over the spot size of a certain range, In the part where a beam meets with a retina a beam moreover, concentration or in order to make it un-concentrate Since it irradiates combining the laser radiation line from the laser centralized equipment combined with laser equipment, the visible light source which irradiates; retina, and; laser centralized equipment, and the visible ray from the visible light source to a retina The equipment and; which are made to ****** a retina are included so that the optical equipment combined with laser centralized

equipment and the visible light source, the position of the laser radiation line on; retina, spot size, and a focus can be observed.
[0011] The clear advantage of this invention is giving the versatility which was not acquired by retina photocoagulation laser system until now. Especially, although a doctor can change the spot size which is in a focus over the spot size of a certain field, he can also irradiate a beam in the mode in which it does not concentrate, over the spot size of the range which laps with the spot size which can be generated in concentration mode partially or on the whole. Thereby, while a doctor can choose the wavelength, strength, and contact lens of a laser radiation line which fitted the specific treatment purpose most, lessening the opportunity of the cornea injury by the energy absorption from laser is guaranteed.
[0012] Other advantages and features of a drawing to detailed explanation of the following of a desirable example and this invention will become clear.
[0013] With reference to drawing 1 , the retina solidification laser system 10 of this invention is explained here. Laser system contains the laser equipment 12 for generating the laser radiation line beam which has the wavelength suitable for necessary curative treatment, and strength. Laser equipment 12 contains the suitable laser 14 and the laser control unit 16. Laser equipment receives power from a suitable external energy source, and it is sent to laser 14 in the controlled mode. The laser equipment which generally fitted photocoagulation treatment, especially retina treatment contains laser and the coherent company laser which gives the both sides of a laser control unit, and is the argon laser console of a coherent company. Model no.920A, argon-krypton laser console Model no.920 A/K and die laser console of a coherent company The coherent company Novus2000 is included with model no.920 A/DYE.
[0014] Laser equipment 12 is combined with laser centralized equipment 20 by the laser transport unit 18. Although the suitable arbitrary waveguides which have the effective transfer capacity of the laser radiation line of necessary wavelength will be suitable, generally a laser transport unit is the cable of an optical fiber.
[0015] Laser centralized equipment 20 controls the spot size and concentration mode of a laser radiation line which are generated by laser equipment 12. Laser centralized equipment can contain the arbitrary systems of structure ** which can concentrate a lens, a mirror, or other laser radiation lines. To constitute laser centralized equipment from a form of the focal distance adjustment formula lens system which makes it possible to change the spot size of the laser radiation line in a target, and also makes it possible to irradiate a spot in concentration or the mode in which it does not concentrate, in the spot size of a certain necessary range is desired. In concentration or the mode in which it does not concentrate, it is guaranteed that safe energy-density level can be maintained in a cornea organization by the versatility which can send various spot size while giving for the purpose of effective medication of a laser radiation line.
[0016] The optical equipment 24 which accepts and sends out the laser radiation line to a retina is combined with laser centralized equipment 20. In the example shown in drawing 1 , the first mirror 26 which accepts a laser radiation line from laser centralized equipment 20, and sends it to a retina is formed in optical equipment 24. The visible light source 28 is also formed in optical equipment 24. The light which the light source 28 generates is received by the second and third mirrors 30 and 32, a mirror turns the light to a retina, and reflects, and this gives lighting required for a doctor to position a laser radiation line. In order that a retina may be countered, a magnifying device 40 may be combined with optical equipment 24 and a doctor may position a laser radiation line correctly between curative treatment, it becomes possible to view a retina. A suitable magnifying device is a microscope which has a scale factor suitable for expansion of a retina. The combination of a magnifying device 40 and optical equipment 24 is called slit lamp often collectively by this contractor. LDS which Japan KOWA (Kowa) manufactures on the slit lamp suitable for using it for this invention for a coherent company Zeiss which 10a and Germany curl TSUAISU (Carl Zeiss) manufacture 30sL is contained.
[0017] It is necessary to use the contact lens 41 of a certain form so that the doctor other than above equipment can double the focus of the image of a retina. Usually, the capacity of the structure of an eye and the doctor who looks at the image by which the lens of an eye and the operation of a cornea were placed on the retina especially is checked. Therefore, a doctor uses one of the various lens systems designed so that an image might be produced in the point which can be decomposed by mechanical arrangement. A contact lens 41 is placed between optical equipment 24 and a retina. A contact lens 41 is arranged so that a cornea may be contacted through the gel beforehand applied to the contact lens by the doctor. In the example of the typical contact lens system used combining retina photocoagulation laser system, it is Goldman (Goldman) 3. Each lens system of a mirror, KURIGA (Krieger), a pan fund scope (Panfundscope), and a main star (Mainster) is contained.
[0018] Next, with reference to drawing 2 , laser centralized equipment 20 is explained more to a detail. In order to obtain the diameter of various laser beams in concentration or the mode in which it does not concentrate, the laser centralized equipment of this invention contains the lens system which has the lens system train in which the some are attached on the cam so that the relative position of a lens can be changed. In the desirable example shown in drawing 2 , a lens system 20 contains the first doublet lens 42. The first single lens 44 is put on distance T1 from the doublet lens 42. The second single lens 46 is in the degree of this sequence, and it is arranged from the first single lens 44 from the first doublet lens to distance T3 again at distance T2. There are one pair of doublet lenses 48 and 50 in the end of a sequence, and it is arranged from the second single lens 46 at distance T4. As the first and the second single lens 44 and 46 mutually moved to distance T2 in distance T1 or T4 to the fixed lenses 42, 48, and 50 again, respectively, a lens is attached into the housing 52 which has cam structure well-known for this contractor.
[0019] The next table 1 shows a lens system, a lens size, and a parameter with the beam-spot size in the lens front

face which obtains the beam which has the diameter of 55micro in a retina. The number of the front face of the lens shown in the first column of a table is expressed to drawing 2 .

[0020]

[Table 1]

表　1

表面	曲率半径	ガラスタイプミリ仕様	ショットガラス銘柄	次の表面までの距離	レンズ表面におけるビーム直径	焦点までの表面の距離
0	0	0		-.031		
60	0	0		65.8	8.009549E-02	1.543574E-04
62	25.26	650.394	BaSF10	2.5	8.227854	152.9218
64	12.18	511.605	K7	3.5	8.093368	-2059.486
66	-44	0		6.649	8.106501	90.88939
68	-66.08	740.283	SF3	2	7.513588	3176.627
70	-939.17	0		18.473	7.509413	761.9482
72	-33.78	626.392	BaSF1	2	7.33079	-93.69418
74	114.17	0		83.878	7.487256	-44.2172
76	169.34	668.419	BaSF6	2	21.68964	-438.7244
78	44.99	640.601	LAK01	4.7	21.7885	-367.2943
80	-103.76	0		.2	22.06731	557.5167
82	103.76	613.587	SK4	5.3	22.05939	208.7941
84	-41.2	668.419	BaSF6	2	21.49943	255.6317
86	-349.79	0		117.15	21.33124	117.1495
88	0	0		-.0005	5.500151E-02	-5.264282E-04

[0021] In the specific example of this invention, a lens system operates in concentration mode over the range of with a diameters [50-200micro] spot size. Generally in this range, the energy density which passes along a cornea does not become a problem. If 200micro is exceeded, the concentration beam in a retina will generate the energy density in a cornea which may pose a problem in a certain disposal. Therefore, with the old equipment of this grantee, much more increase of spot size was attained by carrying out decentralization of the beam.

[0022] This lens system can increase the spot size of a beam similarly. However, according to this invention, the beam diameter adjustment mode of an alternative of having maintained the focus of a beam at a retina can be chosen. A doctor does not make an issue of absorption in a cornea, but if it chooses to see the point formed well taking a measure, the latter alternative will be chosen in many cases.

[0023] Drawing 3 illustrates movement of the lenses 44 and 46 in the form of the interval T1 of front faces 66 and 68, and the interval T3 of front faces 66 and 72 in two modes of operation. While lenses 44 and 46 had connected the focus of a spot on the retina, lenses 44 and 46 move in the early spot-size range, so that clearly (to 200micro).

[0024] When beam-spot size reaches the diameter of 200micro, a doctor can choose one of the two alternative modes of beam extension. Extending the diameter of the vena contracta of a beam, a lens moves in concentration mode so that the vena contracta of a beam may be maintained at a retina. In order to extend the diameter of the beam in a disposal part, a lens moves in the alternative mode in which it does not concentrate so that the position of the vena contracta of a beam may be changed.

[0025] Selection in necessary mode is incorporable into hardware with the adjust ring similar to being used for choosing macro setting with the zoom lens of the conventional camera. By covering the spot size of the given range, shifting and being able to choose that mode, texture ****** can do how a doctor advances best [to the given disposal].

[0026] Without exceeding the energy density of a cornea indicated that science reference is [the laser system of this invention] detrimental, it is both concentration and the mode in which it does not concentrate, and it was designed so that the various laser radiation lines of necessary wavelength and strength might be irradiated. The energy density of the cornea exceeding 10w/mm2 turns out that a certain organization destruction may be brought to a normal cornea. Therefore, calculation was made about the laser system of this invention, and the examination

which checks the energy density of the cornea in various power level and spot size at both in concentration and the mode in which it does not concentrate was made. The result is shown in the graph of drawing 4 . When irradiation of a laser radiation line is switched to the mode in which it does not concentrate so that it may understand easily, an energy density carries out remarkable reduction. Furthermore, at the typical treatment energy level reported to reference, the energy density of a cornea is a low not a little than the threshold of 10w/mm2 by which the injury on the cornea of a certain grade was observed.

[0027] It is clear that the method's [the equipment and the method] of this invention for irradiating the treatment laser radiation line of a specific spot size in both concentration and the mode in which it does not concentrate improvement which excels existing retina photocoagulation laser system is shown. Naturally other examples are possible, without deviating from invention indicated by this specification although a certain desirable example should be indicated, it be illustrated and it explains. Therefore, it is meant that this invention is defined according to a claim and its equivalent matter.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is explanatory drawing of the retina photocoagulation laser system of this invention.
[Drawing 2] It is the explanation cross section of the lens system of this invention.
[Drawing 3] It is the graph of the lens interval in the lens system of this invention.
[Drawing 4] Goldman (Goldmann) 3 the logarithm of the cornea energy density to the spot size in either of the concentration or the modes in which it does not concentrate covering the range of the given beam strength using the mirror (Mirror) contact lens — it is a graph
[Description of Notations]
10 Laser System
12 Laser Equipment
14 Laser
16 Laser Control Unit
20 Laser Centralized Equipment
24 Optical Equipment
28 Visible Light Source
40 Magnifying Device

[Translation done.]